91602
new 82-10

ontario hydro
research division

To: Mr. A. Johnstone
Distribution Lines Supervisor
Eastern Region

ELECTROMAGNETIC INTERFERENCE (EMI) INVESTIGATION - OTTAWA AREA

D.R. Goldthorpe

Two EMI customer complaints were investigated in the Ottawa area. The major EMI sources were identified and the corrective maintenance will be completed by the Regional crew as soon as possible.

INTRODUCTION

The System Studies Section, Communications Group received a request from Distribution Lines Supervisor, Al Johnstone of Eastern Region to investigate a recurring TV interference problem. The problem was on Line 79 M1, 115 kV twin wood pole construction, near the Township of Cumberland. A Mr. J.B. Little (the complainant) was quite concerned about the fact that the interference affected his business (a trailer park) along with his own TV reception. On arrival at Merivale TS another location of concern was requested to be investigated. This was on a steel tower transmission line, M5G M4G at 110 kV. The complainant, Mr. J. King, had complained about an interference source affecting his ham radio equipment. This report summarizes the results of the investigations carried out on October 7, and 8, 1986.

INSTRUMENTATION

The instrumentation used in the investigation is summarized in the Appendix.

SUMMARY OF TESTS

On the morning of October 8, 1986, Jim Howard, the Regional Line Supervisor and myself went to Mr. King's residence on 1152 Tara Drive to assess his TV and ham radio interference problem. No one was home so we proceeded to a nearby turning tower #16 on the transmission line, M5G M4G, beside St. Daniel school. A check for noise sources was carried out with our instrumentation. A definite gap noise source was present as indicated by our noise meter and oscilloscope. The noise level was 66 dB*. Other locations close to this area were then surveyed to determine the exact source of this interference. At the other locations the noise level was substantially lower, thus indicating the initial turning tower surveyed to be the location of the main source.

Turning towers, from our past experiences, have often caused TVI problems due to the insulator strings for loop supports. The insulator string is often installed without anti-interference pins inside the insulators. Also the loop is sometimes strung too tightly and pushes the insulator string up, bending the string and causing loose joints which result in gap-type noise sources. This is the probable cause of the interference. Mr. J. King's residence was revisited later in the afternoon when it was raining lightly. Our instrumentation indicated that there was no noise source from the tower at this time. He also confirmed that his ham radio equipment was free of any interference. The results suggest that the main EMI source is on the first turning tower #16 surveyed. It is in close proximity to the complainant's transmitting and receiving tower and within his antenna line-of-sight.

The TVI complaint by Mr. J.B. Little in the Township of Cumberland was also investigated on October 8, 1986. He was at home so we were able to assess his TV interference. There was a definite problem resembling gap type noise, long black streaks moving in two bands up his screen. These were evident even on the higher frequency channels indicating that the noise sources were fairly close and/or very severe.

The twin wood pole line 79 M1 at 115 kV apparently has had maintenance completed on it, however it was restricted to only a few poles close to the complainant's house and the TVI problem had not been eliminated.

Due to the overland route of the line there were only a few points of access. The EMI mobile test truck could take measurements at only the cross roads. A measurement was taken outside the complainant's house. Tne oscilloscope pictures showed two definite gap type (loose hardware) noise sources. However, the noise level was only about 45 dB*, possibly indicating the source to be in the distance. A measurement was then taken inside the trailer park where the noise level increased to 50 dB*. The gap sources were still evident on the oscilloscope. Travelling along the line on foot with the portable interference locators (the RFI gun and the ultrasonic detector) in the direction of maximum noise, two sources were located with the RFI gun and confirmed with the ultrasonic detector. On pole structure number 43, middle phase, the insulator saddle clamp bracket was identified as a definite noise source. Also, on Pole 42, south phase, the insulator saddle clamp bracket, was identified as a noise source. However, it was of lesser magnitude than the noise from Pole 43. Measurements were made from the test van in a small laneway to a Science school fairly close to the problem poles. Here the noise level increased to 56 dB*. The older type saddle clamps are known to produce a small amount of corona noise which does not create TVI. However, from the computer graphs of pulse repetition rates and the oscilloscope pictures (see attached photos) it was confirmed that definite high level gap sources capable of causing interference were also present.

---

* Noise levels were measured on a peak detector at 70 MHz in a 1 MHz bandwidth and are in dB referred to 1 μV at the meter input. To obtain the field intensity of the noise at the antenna in dB above 1 μV/m, add the biconical antenna correction factor which is 6 dB at 70 MHz.

RECOMMENDATIONS AND CONCLUSIONS

Mr. J. King's ham radio interference seems to be due to the steel transmission angle tower #16 beside St. Daniel school on circuits M5G, M4G, F10MV, V12M at 110 kV.

The following work is recommended:

1) Ensure that the loop insulator support strings have anti-interference cotter pins inserted in them.

2) Ensure that the loop is not too tight forcing the insulator string to be bent into compression rather than tension.

3. Ensure that all insulator hardware is tight on the loop support strings.

Considering Mr. J.B. Little's interference from the twin wood pole line 79 Ml - 115 kV, remedial work is recommended on:

1) Pole #43 - Replacement of the middle phase insulator string and saddle clamp conductor bracket.

2) Pole # 42 - Replacement of the south phase insulator string and saddle clamp conductor bracket.

The above corrective maintenance should eliminate the main interference sources and substantially improve the reception.

Approved:

A. F. Baljet

EPD

A.F. Baljet
Manager
Electrical Research Department

Submitted:

Don R Goldthorpe

D.R. Goldthorpe
Technician
System Studies Section

DRG:td

APPENDIX

INSTRUMENTATION

The following instrumentation was used for the investigation.

EMI Mobile Test Facility (truck mounted equipment for calibrated noise measurements)

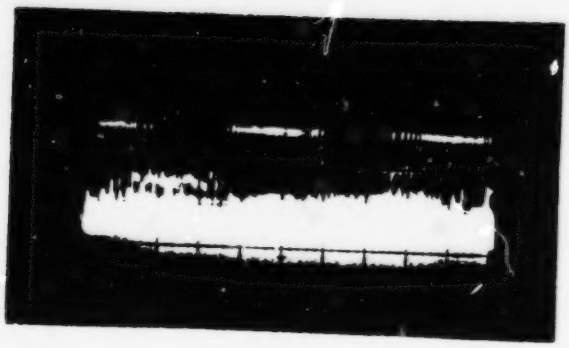
1. Ailtech NM37/57A EMI-Field Intensity Meter for calibrated noise measurements.
2. Oscilloscope connected to linear video output of NM37/57A for observation of noise pulses.
3. HP X-Y Recorder for recording noise spectra (30-200 MHz).
4. Philips chart recorder for monitoring the noise levels at the Y output of NM37/57A.
5. Biconical antenna (30-200 MHz) and extendible truck mounted mast (up to 10 m).
6. Sony TV for visual inspection of interference sources.
7. TVI Analyzer (designed by Research Division) for measuring Average Crossing Rate (ACR) and Amplitude Probability Distribution (APD) characteristics of the noise.
8. HP 9826 computer and thinkjet printer for programmed printouts and graphs of noise measurements.

Portable (hand held instruments) for Locating EMI Sources

1. HP model 4914 Ultrasonic Detector and parabolic reflector.
2. Micro Tech Model 1000 Power Line RFI Gun. (470-890 MHz).
3. Little Snoop (Broad Band Detector).

TVI SOURCES
EXAMPLE OF OSCILLOSCOPE PICTURE
(Mr. J.B. Little's Interference)

Science School Parking Lot



0.5 V/div, 2 ms
Noise meter reading 56 dB
Two gap sources

DISTRIBUTION

Mr. A. Johnstone
Mr. J.M. Howard
Mr. W. Clark

Mr. D. Owen

Mr. E. Rosseau

Mr. R. Wilson
Mr. W.M. Fraser
Mr. J.M. Cameron
Mr. F.W. Midwood
Mr. J.A. Mitchell
Mr. W.A. Ryan
Mr. S.R. Roulston
Mr. G.B. Lomenda
Mr. S.A. Money
Mr. D. Tegart
Mr. C.A. Neal
Mr. R.N. Savage
Mr. G.O. Davidson
Mr. P.M. Richards
Mr. B.C. Mitchell
Mr. A.A. Stanbury
Mr. D.J. Mills
Mr. L.A. Doerr
Mr. R.T. Anderson
Mr. R.E. Edwards
Mr. K.A. Osmars
Mr. A.F. Baljet
Mr. D.C. Lee
Mr. G.K. Hatanaka
Mr. D.F. Townshend
Mr. D.R. Goldthorpe (2)

Public Reference Centre
Editorial Section (2)
Office Copies (2)
Extra Copies (3)

Dist Lines Supervisor, Eastern Rgn
Regn Line Supervisor, Merivale TS
Area Manager, Central Region
Cobourg Office
Area Line Foreman, Central Region
Cobourg Office
Area Line Foreman, Bowmanville
Lakeshore area
Central Region Office
Manager, Distribution Systems, Western Rgn
Dist Lines Supervisor, Western Rgn
P&C Superintendent, Western Rgn
Manager, Distribution Systems, NW Rgn
Dist Lines Supervisor, NW Rgn
Dist Lines Supervisor, NW Rgn
P&C Superintendent, NW Rgn
Manager, Distribution Systems, NE Rgn
Dist Lines Superintendent, NE Rgn
P&C Superintendent, NE Rgn
Tech Supervisor, Telecom, NE Rgn
Manager, Operations, Georgian Bay Rgn
Dist Lines Superintendent, Georgian Bay Rgn
P&C Superintendent, Georgian Bay Rgn
P&C Supervisor, Georgian Bay Rgn
Manager, Distribution Systems, Eastern Rgn
Dist Lines Superintendent, Eastern Rgn
P&C Superintendent, Eastern Rgn
Manager, Distribution Systems, Central Rgn
Dist Lines Superintendent, Central Rgn
Electrical Research
Electrical Research
Electrical Research
Electrical Research
Electrical Research